

invention over the cited prior art. It is respectfully submitted that claims 1 and 10 are now in condition for allowance.

Applicant has amended claim 1 to recite a method of generating power utilizing a gas distribution network and claim 10 to recite a satellite assembly. The gas distribution network is comprised of a high pressure gas reservoir, a low pressure gas delivery pipeline and a conduit operatively connecting the reservoir and pipeline. The method of generating power includes the step of directing at least a portion of the gas flowing between the high pressure reservoir and a low pressure delivery pipeline through a line which is free of a heat exchange member driven by a thermal machine, to the satellite assembly to generate power. Importantly, the satellite assembly generates power based upon the flow of gas through the expander and without combustion of gas.

The unique and novel method and apparatus for generating power in accordance with the present invention provides an extremely economical method and economical apparatus for generating power which utilizes at least a portion of the flow of gas between a high pressure reservoir and the low pressure reservoir or pipeline to generate power without combustion of the gas. Importantly, the present invention requires that at least a portion of the gas flow from the high pressure line to the low pressure line is directed through the satellite assembly or expander to generate power. Accordingly, the power provided by the present invention does not result from

the combustion of any gases, a method which provides an environmentally safe method of generating power as well as an economical method of generating power which utilizes only a portion of the gas flow to generate power.

The Examiner has rejected amended claims 1-8 and 10-16 as being either fully anticipated or obvious over European Patent Publication 0 004 398. However, this teaching is inadequate and lacking because it requires "a heat exchange member driven by a thermal machine," to be positioned in the line connecting the high pressure and low pressure before the line enters the turbine. Thus, the requirement in this publication of "a thermal machine" renders this teaching severely deficient. This "thermal machine," for example, could be an internal combustion machine, a gas turbine driving an electric current generator, a diesel engine or the like. This is a teaching by this prior art patent that the heat exchanger W is required to be "fed the heat losses of the thermal machine M." Accordingly, the '398 patent teaches that the generation of power is the result of combustion, a reaction between an oxidant and fuel, a teaching absolutely contrary to the present claimed invention.

The Examiner has indicated that he has fully considered the arguments presented by applicant in applicant's first response to the Examiner's initial rejection but that they were not persuasive. Also, the Examiner reasons that applicant has elected a specie directed to the embodiment of FIG. 3 which itself includes a heater/cooler 35. Finally, the Examiner

contends that the EPA '398 patent has a heat exchanger for also heating the high pressure gas prior to its expansion. Therefore, the Examiner concludes that applicant's arguments "free of a heat exchanger member driven by a thermal machine" are not valid. It is respectfully requested that the Examiner reconsider this interpretation and understanding of the claimed invention for the following reasons.

The discussion of the present claimed invention on page 9, line 21 through page 10, line 11 unequivalently states that the satellite assembly for generating power within a gas distribution network includes an expander and shaft member, an electrical generator member operatively associated or coupled to the shaft and control means for predeterminedly for controlling the pressure drop and flow of the compressed gas from a high pressure reservoir through the expander to the low pressure pipeline. Also, the last sentence on page 10, lines 6-11 points out the method of generating power includes the step of directing at least a portion of the high pressure gas, contained within the high pressure reservoir, through the satellite assembly to generate electrical power. Thus, it is simply not true that the present claimed invention requires a heater/cooler 35 to generate power or that such a device is equivalent to a heat exchanger member as described in the prior art. Also, the disclosure on page 19 line 8 et seq. states that the expander and shaft member 27 is operatively coupled with a generator 28 in the gas distribution network which utilizes the compressed high pressure

gas storage reservoir and the flow thereof back to the low pressure pipeline, as shown in FIG. 3. Thus, it is simply not seen how the Examiner can conclude that we have the specie described in the embodiment of FIG. 3 must include a heater/cooler 35. Page 14 line 5 et seq. points out that the heater/cooler is a secondary control means 35. However, such a requirement is included in a dependent claim 9 wherein a cooler member is positioned in the line exiting the expander to provide refrigeration or district cooling.

Additionally, the Examiner's reliance upon EPA '398 as anticipating or rendering obvious the present claimed invention is misplaced because the Examiner concludes that EPA '398 patent does not burn fuel because the fuel supply to the engine M is not disclosed. The Examiner should note that the European Patent is designed to distribute gas through a high pressure system on the order of 70 bars, and it is expanded to a low pressure of service, on the order of 1 bar (or 1 atmosphere). One having ordinary skill in the art would understand that approximately 20 heat exchangers would be required to reduce the gas pressure from 70 bars to 1 bar. Even this analysis assumes that only heat (Enthalpy) is considered. Other properties and materials necessary for proper analysis of the '398 system are the properties of specific heat with respect to temperature, condensing and fusion points, pressure and entropy. Also, the efficiency of the heat engines disclosed as useful in the '398 patent is about 18 percent. Transferring heat from one machine

to another reduces efficiency because the heat becomes unavailable. Thus, the unavailable energy is about 80 percent. Thus, the flow of gas changes temperature by between one BTU/degree/pound (Specific heat) and the heating value per unit weight of methane, for example, is 23,875 Btw/lb. This differential or flame temperature is 23,875°F, if 100 percent efficiency is to be recovered. At 18 percent efficiency, the flame temperature would approach 4298°F. This temperature exceeds the temperature that can be withstood by the blades and metal of the known gas turbine expanders, which of necessity are limited to about 2500°F. Thus, the '398 patent teaching is totally inaccurate and no solution to the problems solved by the present invention. Accordingly, the Examiner's position is erroneously based upon the conclusion that the delivery of natural gas needs no limitation and can be done with one gas turbine or combustion device and, thus, the patent '398 has no limitations. This is unsound for the following reasons.

One bar is the definition of the pressure of the atmosphere as measured by a barometer. Unfortunately, such a system has an extremely bad safety record because air will indraft into any pressure system which has internal movement. Indraft is an inward flow or current. An indraft of cold air may cause an explosion of fuel and air. Internal flow will drop the pressure even if the static or non-moving pressure seemingly prevents it. This is the principle of aspiration with which engineers skilled in this art are familiar. Thus, in accordance

with the French patent, no disclosure or teaching is made that the output of the thermal machines must be vented to the atmosphere or flared to the atmosphere. This results in a loss of safety which can result in a large and damaging explosion. When expanding from a 70 bar high pressure system (10,287 psia at sea level) to 1 bar (14.696 psia at sea level), even with pure methane, the production of electricity ceases to increase much after about 100 psia of pressure drop. Thus, the French patent does not illustrate or disclose the specifics of the internal combustion engines except that it describes that they are there, no fuel inputs are shown and there is no flue gas exit. Also, a stack or chimney is necessary. The unavoidable losses in an internal combustion engine which drives the heat exchangers will affect the temperature of the gas. These losses are the gas burned, the water formed, the CO<sub>2</sub> and other gases formed, and the temperature of the flue gas leaving the chimney. The radiation and conduction from the thermal machine, the electricity generated by the generators and expanders and the losses of all the generators result in a situation where the French patent will not permit operation except with a heat exchanger in the system. Accordingly, applicant's claims, which specifically exclude a heat exchanger member driven by a thermal machine, is a valid limitation to the method and apparatus which clearly distinguishes the claimed inventions from the EPA '398 patent.

Additionally, applicant respectfully request the Examiner to reconsider the further arguments presented in the

response filed with the Patent Office on May 15, 1998. Suffice to say, the present invention relates to a method of generating power without combustion of gas, a result which simply cannot be obtained or achieved by the Examiner's references. Hence, the Examiner's prior art teaching of the requirement of the need for a heat exchanger coupled to a combustion engine or another type of thermal machine to assist the distribution of system is not a teaching of the present claimed invention, but is antithetical thereto.

For each and all of the reasons set forth above with respect to distinguishing the features of the present invention over the '398 patent, it is respectfully submitted that claims 1-8 and 10-16 are in condition for allowance. Applicant has reviewed the prior art made of record and can find no teaching of the present claimed invention.

Respectfully submitted,

ROBERT M. LUNDBERG

By: Paul L Brown 27,184  
Paul L. Brown, Reg. No. 27,184

Emrich & Dithmar  
300 South Wacker Drive  
Suite 3000  
Chicago, Illinois 60606  
Phone: 312-663-9800  
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